THREAT and ERROR MANAGEMENT TRAINING

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ABSTRACT

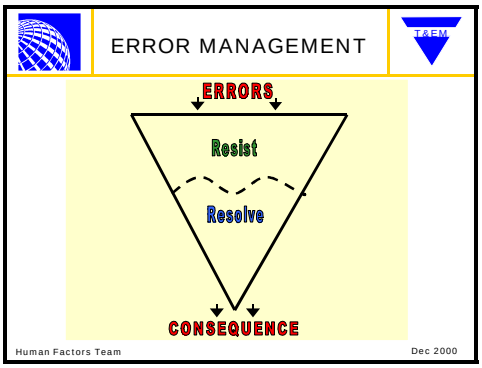
Line Operational Safety Audit (LOSA) data have three major uses – for research, for organizational safety initiatives, and for the development of training curricula[1]. The development and format of an "Error Management" (EM) course is reviewed and how the data from a follow on LOSA confirms the effect of the training. From the follow-on LOSA, data is then used to develop the new "Threat & Error Management" (T&EM) course.

1996 LOSA

In 1996 Continental Airlines conducted a system-wide Line Operation Safety Audit (LOSA). LOSA is a non-jeopardy observation of line crews during normal operations. LOSA is designed to identify overt and latent threats, crew errors, and aggregate crew performance on how threats/errors are managed (use of counter-measures). LOSA also identifies the links between crew errors, threats and other errors, as they become the precursors to accidents/incidents. It is far more important to use LOSA data to affect system changes than policing individual crews or pilots. Based on the 1996 LOSA results, Continental focused on crew error and the countermeasures necessary to avoid, trap and mitigate errors before they became consequential. Working with the University of Texas Human Factors Research Project Team, Continental developed an "Error Management" course that differed from previous CRM programs.

Error Management

Starting in 1997, all Continental pilots began attending a new CRM course named "Error Management." Pilot's gained an understanding of human (pilot) error, error avoidance, error-trapping and mitigating the consequence of error. A major focus of the course was on the realization that all crew errors cannot, and will not be avoided. Therefore, crews must use all means to successfully resolve the error(s) to reduce or eliminate the consequences.



The course introduced how SOP's, checklists, etc. (Resist) are important guards against possible errors and how the use of CRM counter-measure skills (Resolve) can be practiced and improved to more effectively manage error. Additionally, all Check Airmen were trained in identifying crew error and to reward effective "error management" when it was present and not just focus on a crew's lack of success in trying to avoid all error. The CRM markers and "error management" were also imbedded in training courses where crews are held accountable not only for their technical skills but also their skills at *using* CRM markers as effective error counter-measures.

The operations safety change process that began with LOSA 1996 was about to complete a full cycle: 1) use LOSA to collect error data in line operations, 2). Flight Standards & Training use LOSA analysis to make changes, 3). Line pilots receive training on the changes, 4). Conduct a follow-on LOSA to measure the effectiveness of the changes. It has always been difficult to collect hard data on the value of CRM courses and their effect on crew performance. However, the system-wide LOSA 2000, conducted after completion of the Error Management Course, provided measurement against the base line data collected in LOSA 1996.

[1] "System Safety and Threat and Error Management: The Line Operational Safety Audit (LOSA)."
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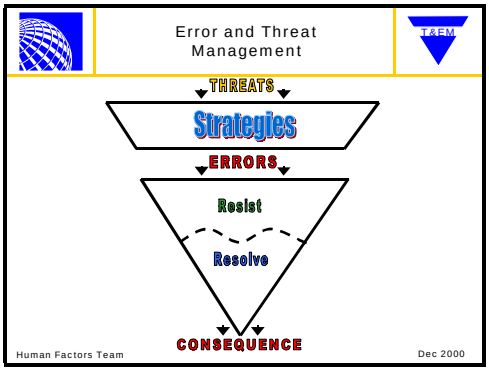
Robert L. Helmreich, James R. Klinect, John A. Wilhelm & J. Bryan Sexton

LOSA 2000

The Line Operational Safety Audit (LOSA) 2000, when compared to the 1996 LOSA, showed that the CAL pilots not only accepted the principals of "Error Management" but had incorporated them into their everyday operation on the line. LOSA 2000 showed a sizeable improvement in the areas of checklist usage, a 70% reduction in non-conforming (not meeting stabilized approach criteria) approaches and an increase in overall crew performance. While conducting LOSA 2000 observations, the observers saw another area of crew performance that needed to be addressed in addition to "Error Management". The new area of crew performance concerned threat recognition and threat management. The LOSA 2000 data and analysis concerning threats led to the development of the current 2001 Threat and Error Management CRM course.

Threat & Error Management

Based on the premise that crew errors occur on <u>normal</u> daily flights, a question was formed from pilot discussions during the Error Management training. The question is: what defines a "normal flight"? The answer decided upon, defined a normal flight as one having no threats. This would be considered a pristine flight, requiring no crew effort to change anything from the plan, through the execution, of flying from departure to destination. While this is unusual, it does happen. That being the case, the LOSA 2000 team defined a threat as anything that requires a crewmember's time/attention/action above and beyond the tasks of a pristine flight. LOSA *2000* observers were trained to observe the threats crews faced and how they were managed. These were external threats (weather, maintenance, passenger problems, operational pressures, distractions/interruptions, ATC errors /language/communications problems, etc.) that were not crew errors but came from external sources and increased the potential for error, if not managed properly. What surfaced during these observations were the strategies good pilots use to effectively manage threats. These strategies, pro-active in nature, were sometimes personal techniques that pilots have developed over time in order to effectively operate in today's complex environment. Other strategies that are common and used routinely have developed into procedures (SOP's). An example would be the use of a pre-departure briefing to review a power loss on take-off. This briefing prepares the crew to make a better decision, should a loss of power occur when risk is high and decision time is minimal. Crews that effectively use strategies manage external threats successfully and reduce crew errors associated with these threats.



Threats = "Red Flags": In reviewing several accidents and incidents over the last several years, it became apparent that where there were several threats not properly managed. There were also crew errors that together, played a significant role in the mishap. Threats must be identified and assessed as "Red Flag" warnings. When crews successfully recognize and acknowledge threats as red flags, they are in a better position to manage that threat so it becomes inconsequential. Accident/incident crews typically do not recognize all the threats, or their severity, and accumulate red flags, which invites crew error. Crews are most vulnerable when they acquire several threats, (red flags) and have employed no strategies to manage them. Accumulation of red flags places the crew at the edge or corner of the operating envelope where time and options are limited. To effectively manage threats, they must be identified, then assessed, and then countered. Identification of threats comes through many system alerting methods i.e. aircraft system alerting lights, bells, horns, voice, and devices such as GPWS, TCAS, winds hear etc. Those devices may also show the best course of action to counter the threat. However, there are not systems and devices to detect, assess, and counter all threats. Effective use of CRM counter-measures provides primary threat detection and management for threats not having system alerts, and provides backup for those that do. Abundant examples exist showing that failure to employ CRM counter-measures was the last option for detecting a threat that ended in a CFIT accident with the GPWS warning sounding for 30 seconds or more with no corrective action taken by the crew .One of the primary counter-measures to managing threats effectively is Flight Deck Leadership. The attributes of Flight Deck Leadership (setting the example, planning ahead, initiative, fostering communications, etc.) are the foundation for effective strategies to manage the threats crews face every day.

. Effective “Red Flag” (threat) management reduces the complexity of the operating environment, decreasing the potential of crew error. Strategies, whether personal or SOP, need to be employed consistently so threats can be more easily recognized and managed. Interactive communications, vigilance, monitoring & challenging are full time strategies the assist crews in identifying “Red Flags.” These countermeasures aren’t developed at the time of the event but are developed and deployed pro-actively. In academic terms it means, “Get your stuff together before the stuff hits the fan,” or words to that effect. The environment we operate in has only become more complex over the last few years and will continue to present our pilots with an increased number of challenges. As a pilot group we must “raise the bar” and accept that outstanding performance today will only be standard in the future. We must improve ourselves to reach that new above standard performance level. “Threat & Error Management” training is one of the means pilots can use to reach an improved level of performance that will enable them to deal with the increased challenges of maintaining a safe operation. The idea behind all CRM courses is to define the “best practices” in applying threat and error management counter-measures to reduce or eliminate the consequence of threats and errors, which are the precursors of accidents and incidents. Safer operations can be had by imbedding the best practices of our pilots into our training and everyday operation. Pilots learn many of their positive traits from the sharing of ideas and experiences with their peers and then applying them to their own operational philosophy. The “Threat & Error Management” course is a means by which the pilots can prepare for the future and be part of the team successfully building a threat and error management culture.